

Exploring the importance of learning biosciences as a way of developing safe practice in Operating Department Practice (ODP)

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Abstract

This paper explores the development of bioscience knowledge in the pre-registration Operating Department Practice (ODP) curriculum. The context in which ODPs practice has changed significantly due to a number of factors, including the changing nature of disease and the resulting advances in treatment, and hence the professional role and the associated bioscience knowledge requirements have also changed to meet these needs. This research therefore explores the student experience of bioscience learning and the impact upon perioperative care delivery.

This study adopted a mixed methods, quantitative and qualitative, approach where phase one collected predominantly quantitative data via a questionnaire; and phase two explored the themes identified from the questionnaire via a focus group. The study participants were all final year pre-registration students studying the Diploma in Higher Education (DipHE) in Operating Department Practice (ODP) at Birmingham City University.

This research has shown that majority (93%) of ODP students recognise the importance of biosciences as part of their professional role and were able to apply this to the different roles undertaken by the ODP; for example, the administration of prescribed medication in the post-anaesthetic care unit and the understanding of the surgical intervention whilst in the scrubbed role. Students identified that an understanding of biosciences was essential for safe care delivery but also commented that this understanding allowed the provision of individualised, empathetic care, thus demonstrating a link between biosciences and the wider concepts of perioperative care.

This study also explored the location of bioscience learning and the majority of students (63%) felt that principle acquisition of bioscience knowledge was via university teaching rather than on placement. Students did however identify that mentors and other clinical staff supported the application of bioscience knowledge during their clinical placements and hence we believe that this presents an area of further research.

This small-scale study has demonstrated that ODP students value the importance of bioscience as part of their professional education and particularly the university based teaching to inform this. Our findings

have supported the research from other health professions, which has demonstrated the relationship between bioscience knowledge and the delivery of safe, effective patient care. We believe that these findings, especially those which demonstrate a disconnect between theory and practice learning, suggest that there is a need to review the philosophy which underpins the national curriculum for ODPs.

Introduction

This paper focuses on a study that sought to investigate the learning and application of biosciences in the undergraduate Operating Department Practitioner (ODP) curriculum. ODPs practice predominantly within the operating theatre and are recognised as the only healthcare professionals to gain a pre-registration qualification specific to the care of the perioperative patient (Abbott and Wordsworth, 2014). In so doing it has been recognised that there are a number of core bioscience topics that underpin all healthcare practice such as physiology, immunology, pharmacology, genetics and microbiology (McVicar & Cancy 2001; Smales 2010). Within the literature, however, other discipline areas have been included within a broader conceptual appreciation of the term 'biosciences' to also include; pathology, pathophysiology, cell biology and neuroscience (McColl *et. al.* 2012; Tayler *et. al.* 2015).

We argue that both the topic and indeed the application of biosciences to the ODP profession is particular apposite given the rapidly changing context in which perioperative care is now delivered. This context has been a major catalyst for evolution and change in the role of the ODP, in which the growing autonomy of the profession has resulted in the development of the ODP's threshold scope of practice, and is clearly described in statutory standards of proficiency (HCPC 2015). In many cases these changes arguably emphasise the importance of a greater understanding and application of biosciences to equip the ODP to address any knowledge and skills deficits demanded by the changing role. Therefore this paper explores simultaneously the drivers for enhanced bioscience teaching and learning as well as reports on research which aims to determine student perceptions of whether they themselves consider that bioscience knowledge is important to the development of their competence and professional role.

The Changing Context of Perioperative Care

The perioperative environment has been identified by Abbott (2014:31) as 'a dynamic environment which is continually evolving to meet increasingly complex needs' of the individual patient and the possibilities for surgical and anaesthetic interventions. We therefore argue that the ODP is required to develop a specialised skill-set to enable them to effectively assess and develop a plan of care, but which is inevitably underpinned by the application of bioscience knowledge. This view is predicated on our belief that bioscience knowledge is necessary to underpin competence and safe practice. To explore this assumption further it is necessary to understand in more detail the context of practice and the role in which the ODP must remain competent.

Perioperative care has changed significantly, particularly in the recognition of the changing nature of disease and illness and the subsequent advancement in treatments (DH, 2008). Health demographics nationally and particularly in the West Midlands, where this study took place, indicate that the risk of chronic disease, for example heart disease, are major pre-cursors to surgical intervention of some kind. Additionally surgical treatment of an ageing population with complex co-morbidities and long-term conditions has influenced the nature of perioperative care. Other developments, such as the expansion of day case surgery and ambulatory care along with targets for cancer care to address national priorities, have resulted in the need for a greater availability of surgical time, thereby increasing the number of operations carried out by 60% from 2002/3 to 2012/13 (NHS Confederation, 2014).

The Changing Role of the Operating Department Practitioner and the increasing requirement for bioscience knowledge

It is perhaps worth remembering when embarking on an exploration of the curriculum and its content, that the profession has emerged from a traditionally vocational past in which the acquisition of psychomotor skills was paramount. Yet as the perioperative environment continues to develop, the ODP's knowledge and skills must inevitably advance in order to meet new demands (Abbott, 2014). Furthermore, the practitioner has a professional 'responsibility to recognise any deficits in their skills and knowledge' (Wordsworth, 2014: 155) in order to ensure safe practice.

This paper addresses the extent to which this changing role and context of practice is likely to require an increased focus on bioscience knowledge within the pre-registration curriculum. Abbott and Wordsworth

(2014) have recently discussed the high-risk nature of the perioperative environment and the critical role of the ODP in identifying and mitigating against clinical risk. The fact is that the operating theatre is potentially so high risk is amplified in the fact that 9 out of 15 “never events” described as ‘serious largely preventable patient safety incidents’ (NHS England, 2015), can in fact be directly related to a range of clinical practices that ODPs are routinely involved in. While a high proportion of these “never events” such as wrong site surgery, (NHS England, 2015), can be attributed to human factors; a number of these incidents could also be attributed to a lack of underpinning bioscience knowledge. For example the “never events” pertaining to medication administration (NHS England, 2015), may be attributed to human error or it may also be due to a lack of basic pharmacological knowledge.

Furthermore the role of the scrub ODP has evolved to include a number of skills that were previously considered as ‘advanced’. This includes skin preparation, patient draping, and male urethral catheterisation (following appropriate training and competency assessment). The scrub practitioner is also able to undertake superficial skin and tissue retraction and assist in wound closure, including cutting superficial sutures (PCC, 2012), skills which clearly align with specific elements of bioscience related knowledge such as anatomy and physiology. The introduction of Modernising Medical Careers (DH, 2003) as well as compliance with the EU Working Time Directive (DH, 2009) also continues to impact on the availability and skills of medical staffing within the operating theatre. This has the potential to lead to further advanced roles and responsibilities, which were once the responsibility of the medical practitioner, the implication being that that a greater depth of knowledge is required by the ODP in order that the patient continues to receive high quality patient care (CODP, 2010).

A sound underpinning bioscience knowledge within the pre-registration curriculum is also essential to allow ODPs to develop into advanced post-registration clinical roles. These include the Physician’s Assistant [Anaesthesia] (PA[A]) who, as a member of the anaesthetic team, ‘is trained both in the underlying scientific and medical knowledge pertinent to anaesthesia, and in the skills of administering anaesthesia” (AAGBI, 2011: 3), and hence is synonymous with scientific knowledge. Interestingly a recent survey carried out by the AAGBI (2011) showed that 33% of PA[A]s were originally from an ODP background. There is a similar advanced role related to surgery which requires a comprehensive understanding of normal and altered anatomy and physiology; as the Surgical Care Practitioner (SCP), “performs surgical intervention, pre-operative and post-operative care under the direction and supervision of a Consultant surgeon” (RCS, 2014: 13). As in other healthcare disciplines this added complexity of advanced practice has led to the development of educational programmes equivalent to Masters level study incorporating a significant proportion of the content related to anatomy and physiology, advanced health assessment, differential diagnosis and pharmacological therapies. Hence ODPs require robust underpinning bioscience knowledge to support ongoing career development, professional credibility, clinical competence and safe practice.

Revised standards of proficiency and bioscience for safe practice

The relationship of bioscience and safe clinical practice has impacted upon the undergraduate curriculum. Indeed the increasing bioscience content as an important and growing feature of the body of knowledge for the profession has also been recognised in a statutory context following the publication of the revised HCPC (2014) Standards of Proficiency (SoPs). These standards define safe and effective practice for each of the professions that the HCPC regulates, and in so doing act as threshold standards by which the HCPC seeks to protect the public. Recent changes to the profession specific elements of the ODP SoPs, developed with input from a range of stakeholders and a public consultation, now include both additional and reworded standards directly related to bioscience that clearly define how registrants “must meet the standards relevant to their scope of practice to stay registered” (HCPC, 2014:3).

A number of these reworded standards reflect the development of the professional autonomy and knowledge base of the ODP since the publication of the previous regulatory standards in 2008. Standard 13.1 for example, describes the need to “understand the anatomy and physiology of the human body, together with the knowledge of health, disease, disorder and dysfunction, relevant to their [ODP] profession” (HCPC, 2014:11). The threshold level of pharmacology knowledge has also been revised in standard 13.12 and now requires the ODP to “understand the pharmacokinetic and pharmacodynamic effects and contraindications of drugs used in the perioperative and acute setting” (HCPC, 2014:12). This same need to expand specific pharmacological underpinnings has also been identified in the CODP (2011)

BSc ODP curriculum and by the National Patient Safety Agency (NPSA) (2010) who advocate the use of the second checker for drug preparation and administration in order to avoid the risks associated with incorrect drug administration.

Compliance with these revised standards means that the ODP must now demonstrate possession of appropriate bioscience knowledge to underpin their practice and professional role. Therefore it is essential that all ODPs have a fundamental understanding of the bioscience for on-going patient safety and protection of the public.

Biosciences in the perioperative literature

Elsewhere in the education of the healthcare professions the link between demonstrating knowledge of the biosciences and the ability to practice competently exists as a long-standing and pervasive discourse (Jordan et al. 1999, Danielson & Berntsson, 2007; Smales, 2010; McColl et al. 2012). Indeed a working knowledge of biosciences is often cited as an essential feature of safe and effective practice (Prowse, 2003; Woods, 2007; Trumble, 2012, McColl, 2012). This is not to say that learning scientific principles, almost as a right of passage is not without its challenges, at both the level of the individual and the profession itself, and the former may indeed find the notion of applying abstract knowledge and concepts to their practice challenging (Davies, 2010; McVicar et al., 2010).

There is currently very limited published research relating to the application of biosciences in the perioperative environment; with minimal evidence specifically related to bioscience in ODP education. A study by Prowse and Heath (2005) explored bioscience knowledge and its application specifically in the post-anaesthetic care component of the perioperative environment. This study included a total of 32 experienced nurses who were asked how their bioscience knowledge was applied in the management of the deteriorating patient. The authors concluded that experienced nurses draw heavily on situated kinds of bioscience knowledge to manage a deteriorating clinical situation as part of a process of wider professional interactions with other colleagues. In this sense bioscience was also found to act as a proxy in defining notions of professional boundaries, context and the time frame in which emerging clinical situations can be resolved (Fisher and Fonteyn, 1995; Benner et al. 1996).

The operating theatre environment itself is viewed by Jones and Morris (2006) from a medical perspective as fertile ground in facilitating a wide range of clinical bioscience-based topics as well as skills of a non-technical nature. Similarly, from a nursing point of view, Jaye et al. (2009) argues that the operating theatre can expose students to a wide range of fundamentally important learning experiences, these in turn enable the learner to develop higher levels of competence and cognitive aspects of critical thinking as an enhanced learning taxonomy. Consequently, it would seem clear that ODP students are exposed to bioscience throughout their pre-registration education, both within the academic and clinical environments.

Methods and sources of data used in the study

This paper reports on how ODP students themselves perceive the relevance of biosciences to the development of their role as safe and competent practitioners. Here we only address bioscience in relation to ODPs, however the research was carried out as part of a wider 'Bioscience Learning in Placement (BLIP)' project within the local Education Commission for Quality (ECQ) funded activities (Fell and Dobbins, 2014). The study was conducted at Birmingham City University (BCU) in the 2013/2014 academic year and all final year DipHE ODP students were invited to participate. The university in question has one of the largest pre-registration ODP programmes in the United Kingdom with ODP student numbers commissioned by Health Education West Midlands (HEWM) and by the Ministry of Defence. Students undertake clinical placements throughout the greater West Midlands region and hence this study represents students placed at a wide range of hospitals and in a number of perioperative settings.

This study adopted what is considered 'true' mixed methods using a primary philosophical approach with a secondary approach to enrich the data further (Driessnack et al., 2007; Morse, 2010). The methodological approach to this mixed-methods study was a quantitative and qualitative approach where phase one collected predominantly quantitative data and phase two used a qualitative approach to explore the students' experiences and opinions in depth (Tritter, 2007).

Phase one used a 19-item paper-based questionnaire with predominantly quantitative closed questions although some open questions were included to provide the opportunity for narrative comments. The questionnaires were distributed to ODP students at the beginning of a campus-based teaching session and respondents were able to either complete and return them in the session or complete them later and return via a dedicated collection box. In total, 56 surveys were distributed to ODP students with 46 returned (82% response rate), although not all were completed in full. At the time of distribution, students were also asked to consider participating in follow-up focus group.

The quantitative data from the questionnaires was analysed using the Statistical Package for the Social Sciences (SPSS version 21) to produce descriptive statistics. Qualitative data derived from open questions contained within the questionnaire was analysed inductively and coded to identify the emerging themes and sub-themes.

Following phase one, potential focus group participants were contacted via email and invited to attend a focus group interview; eight ODP students attended this focus group. A semi-structured interview schedule was developed, drawing on the themes identified from the literature review and questionnaire responses. This ensured that key topics were explored whilst allowing flexibility for the researcher to respond to the particular perspectives and experiences of the student group. The focus group discussions were analysed inductively and coded to identify the emerging themes and sub-themes.

Ethical considerations

Ethical approval was obtained from the University Faculty of Health Research Committee. All participants gave their consent prior to taking part. They were assured of the confidentiality and anonymity of their data, and of their rights as research subjects. The study was designed to adhere to the highest principles of educational research ethics, in order to avoid harm to the participants (either physically or psychologically), ensure consent and avoid any invasion of privacy or any form of deception (Bryman, 2004).

Results

The importance of biosciences to the role of the ODP

From the questionnaire responses, it was apparent that students' background knowledge of bioscience at the point of entry to the course varied widely, with entry qualifications ranging from a small number of students with no previous biological science qualifications (4%); to some students with degrees in science related subjects (9%). The majority of ODP students indicated that GCSE grades of A to C (or equivalent) in a biological science related subject, had been their highest level of qualification prior to joining the course (48%).

When participants were asked to provide a view on the importance of biosciences to their professional role, 65% of respondents felt that this was essential to their development as an ODP whilst 28% indicated that it was important or very important (figure 1).

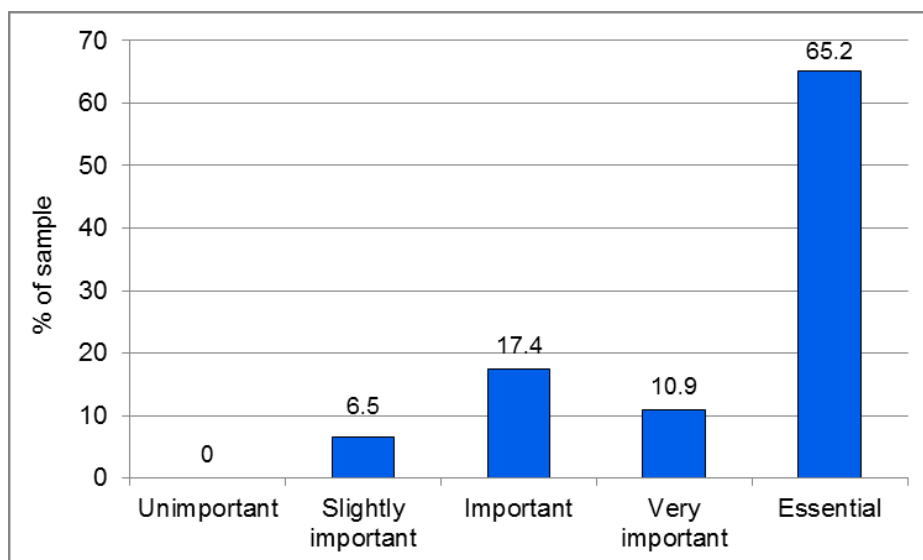


Figure 1: ODP students' responses to questionnaire item: *When you applied for the course you are completing, what was your highest qualification in biology?* (n=46)

When explaining their reasons behind their choice, a number of participants made the link between knowledge of biosciences and a general appreciation that biosciences were fundamental in their day-to-day practice.

Essential for understanding patient care, anaesthetics, surgery – all aspects of ODP role (Q/ S12)

Such views were reinforced in focus group interviews.

It underpins everything that we do (FG/S5)

Others linked the study of biosciences to specific aspects of their role including the use of drugs and the application of pharmacology. One student stated that:

If I don't understand their [anaesthetic drugs] impact on the body how can I identify if a patient is in danger? (Q/S1)

Taking this principle further, several respondents stated a sound understanding of pharmacology was important in order that '... we take particular actions, interpret results and use particular drugs in emergency procedures (Q/S2)'. Other participants felt able to intervene appropriately as a result of 'recognising side effects, indications and contraindications' (Q/S5).

Rather than focus on pharmacology alone, some participants talked about the importance of bioscience in relation to understanding applied anatomy and physiology in order to carry out their role. One student felt that:

When it comes to scrubbing for operations if you have an understanding of A&P it makes the job easier and more interesting (Q/S7)

In relation to assessment and intervention as important aspects of carrying out the role effectively one student felt that:

Being able to recognise, interpret physiological norms is essential to being a good practitioner so you can help treat the patient as a whole and recognise when something may be going wrong/needs treating (Q/ S18).

In summary, several participants suggested that it was important to have in-depth knowledge of bioscience to be a good practitioner and to enable best practice and that it was 'inconceivable' (Q/S35) to suggest otherwise.

The impact of Biosciences on patient care in the perioperative environment

Participants also spoke in more general terms about the importance of bioscience and the impact of this on their ability to provide patient care, suggesting that even to provide an adequate standard of care relied upon having a good understanding of biosciences. More importantly they indicated that in order to provide individual and empathic care it was essential to be able to appreciate 'what patients are going through' (Q/S25). A number of participants further suggested that an understanding of biosciences helped them to better inform patients. It was the basis on which others felt they could 'advocate' (Q/S5) on behalf of the patient and provide better information on issues such as health promotion. In so doing they felt better prepared and informed and were more readily able to appreciate what "what state our patients are in' (Q/S14) and 'what care (interventions) need to be given' (Q/S41).

In contrast, a small number of participants felt that only a basic understanding of biosciences was needed 'in order to follow what the surgeons are doing' (Q/S21). Moreover these students expressed the view that a practical understanding was more important than a theoretical one and that knowledge of bioscience 'is not relevant to perform to the required standards.' (Q/S23).

Learning from placement as a location for applying biosciences

Participants were asked a series of questions around their opportunity to apply biosciences to their clinical placement. Most students indicated that they had gained most of their knowledge from their ODP course (89%), and that this had centred on learning that had resulted from the academic elements of study at university (63%) as opposed to that which they associated with their placement learning (6%). Some participants felt that learning took place evenly between the classroom and whilst on placement (30%).

Following up on this, participants were specifically asked to comment on the extent to which applying bioscience knowledge was emphasised during their placements. Whilst almost 40% of participants felt that 'to some extent' the importance of biosciences was emphasised during placement learning, around 30% of students felt equally that biosciences was emphasised 'to a little extent' or alternatively 'to a great extent' (figure 2).

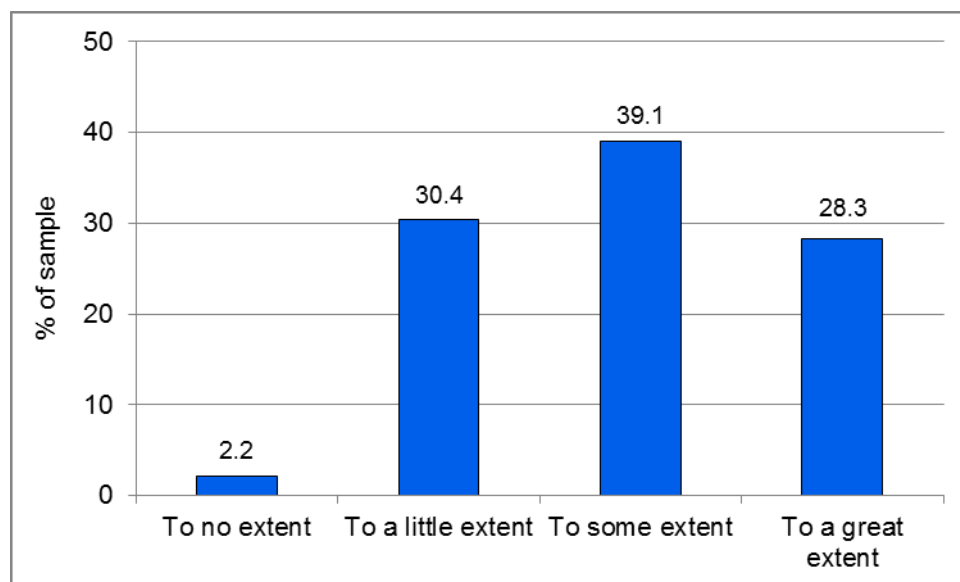


Figure 2: ODP students' responses to questionnaire item: *Overall to what extent was the importance of applying bioscience knowledge emphasised during your placement?* (n=46)

Students were then asked how often they explored the biological sciences associated with a patient's care during placements. Nearly half of the sample (48%) indicated 'often' or 'very often'. The same number again (48%), however, reported that it was 'not very often' that these explorations occurred. Four percent indicated that it was 'never'. The majority of students felt strongly however that it is relevant to their

professional role as an ODP to explore the biosciences associated with a patient's care whilst on placement (98%).

Participants were subsequently asked to provide details of the main methods by which students were able to apply this knowledge whilst on placement.

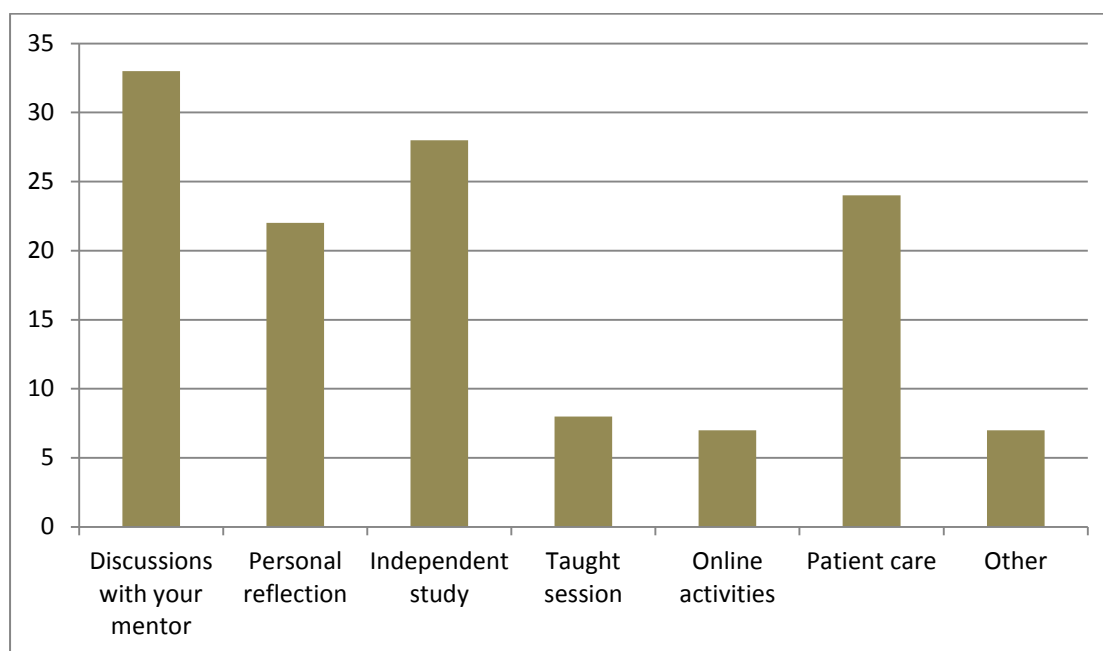


Figure 3: ODP students' responses to questionnaire item: *Can you tell us about the main methods that you have used to apply your bioscience knowledge whilst on placement (tick all that apply)?* (n=46)

Participants indicated that discussions with their mentor were the mostly likely way that they applied their bioscience learning in the practice setting (figure 3). Direct involvement in patient care was also ranked highly. However, the second and third most popular responses indicated that students applied their knowledge through the process of personal reflection or independent study, both of which are solitary pursuits that take place in parallel to gaining practical experience. Only a small number of participants felt that they were able to apply bioscience knowledge through either teaching delivered in practice, or through online activities directly related to placement learning. The 'other' category included responses which indicated that students had applied bioscience knowledge with other professionals who were not formally acting in a mentor capacity, such as the anaesthetist, or during the team brief.

Discussion

Given that developing specific knowledge of the biosciences is considered by many participants to be fundamental to the development of the role of an ODP, it would seem necessary to ensure that students enter the course with a degree of existing baseline knowledge however this is not currently stipulated in the CODP (2011) curriculum document. In this study 46% of students in the study have achieved, as their highest level of science qualification, GCSE at A to C in a science subject. This raises the question as to whether this is adequate preparation or not for a career as an ODP? Moreover, a shift in emphasis toward greater bioscience learning in the curriculum in order to meet revised threshold standards of practice will require an inevitable focus on formal methods of assessment of knowledge and application of the biosciences. As it stands at the moment this could mean that a number of students have little or no specific bioscience knowledge if the current curriculum admissions criteria (CODP, 2011) are not revised. Such a situation could result in students playing catch-up with some of their peers, or worse, find themselves unable to meet the specific demands of the course for which they were unaware and ill prepared.

The fact that cohorts may be sharply divided between those with little or no bioscience knowledge, alongside those who have studied the subject previously with some success, has particular implications for the curriculum, both in its design and implementation. Cohort diversity is not the only concern in this

respect of the curriculum; the issue of staff competence to deliver increased bioscience inputs, as raised by Huggins and Goacher (2013), will also need to be addressed. Teaching teams may need to consider accessing specific and expert inputs from pharmacologist, anatomists and physiologists alike.

Although often considered to be an abstract concept (Davies, 2010), the majority of participants associated bioscience subjects with concrete factual-based *propositional* knowledge (Eraut, 1994). Furthermore, the data suggests that responses appear to broadly conform to McColl's *et. al.* (2012) heuristic of the importance of bioscience to the development of competence (in medicine). Knowledge of scientific principles was considered by participants to be essential to carry out anaesthetic, surgical and post-anaesthetic roles that span the scope of practice for the ODP and which are congruent with the HCPC (2014) revised SoPs. However, for many other participants the abstract nature of bioscience knowledge was quickly assimilated into what Eraut (1994) has describe as *professional* knowledge, this encompasses the use of *propositional* (technical) knowledge, in addition to practical knowhow or *process knowledge*, as well as that which is tacitly derived at through exposure and experience to a particular occupational culture and then applied to and in practice. Ultimately, the majority of participants felt that an appreciation of bioscience knowledge was necessary in order for them to provide safe and effective patient care. Thematically this sense of improving care was expressed in terms of being able to *explain and advocate* on behalf of the patient around their treatment, which McColl *et. al.* (2012) suggests enables key concepts to be explored and explained. Participants also felt bioscience knowledge was important to form a more *informed understanding of the factual nature of the patient's condition*, as McColl *et. al.* (2012) suggest 'to counter irrational thinking about health, disease and medical treatment' (p. 2). Finally, participants felt better equipped with the necessary knowledge and skills to support appropriate surgical interventions, again akin to the view of McColl *et. al.* (2012) that the biosciences are essential for the 'optimisation' of the management of disease or illness.

Returning to the issue of how best to teach biosciences in ODP it is also a question of where. McColl *et. al.* (2012) argue that the significance of bioscience knowledge in developing clinical competence is the fundamental foundation for a 'framework for learning' (p. 2). Indeed some participants felt that learning biosciences should extend beyond qualification and was an essential means of keeping up to date as part of continued professional development. However, the centrality of the placement experience to the development and application of bioscience knowledge also came through strongly in the participant's responses. This was despite the fact that they were not always convinced that bioscience subjects were emphasised enough on placement. Certainly the mentor/student relationship was seen as essential to the application of bioscience learning. Providing patient care and supporting the development of these skills through effective mentorship as part of the placement experience was also seen as a major component of the student's ability to learn from reflection on and in action (Schon, 1983).

Bridging the theory-practice gap, developing critical thinking, recognising and developing the evidence-base, developing independent scholarship are all key factors in the debate surrounding the graduate ODP. If the development of degree programmes is the catalyst for this, perhaps the enhancement of bioscience learning provides the means to do this by acting as 'a scaffold for . . . problem solving using a combination of formal education, self-education and experience' (McColl *et al.* 2012).

Limitations of this study

This study collected data from one cohort of DipHE ODP students at one university and therefore this study is limited by the experiences and views of this cohort. To develop this research further therefore, this study could be repeated with other cohorts of both DipHE and BSc ODP students at this and other universities thus increasing the sample size and limiting the contextual bias.

Conclusion

This paper aimed to explore the learning and application of biosciences within the undergraduate ODP curriculum and it is clear from this work that there is an identified need for significant bioscience content in the pre-registration curriculum. This has been informed by a number of national drivers, for example patient safety initiatives, which require a higher level of threshold knowledge to enable ODPs to identify and mitigate against risks to patient safety.

In this study, students considered bioscience to be fundamental to their role as it underpinned all aspects of their practice. Students specifically identified the relevance of robust anatomical knowledge when working in the scrubbed role, as this enabled them to understand the surgical intervention and hence work in the surgical role more effectively. Physiology and pharmacology were identified as being particularly pertinent to the anaesthetic and post-anaesthetic care roles. This is perhaps not surprising as these are the areas where students would have the most exposure to physiological monitoring and drug preparation and administration. The links between aspects of biosciences and the different roles of the ODP may also be informed by the nature of the discussions with mentors and other team members, for example medics, and therefore there is the potential to explore further the importance of clinical teaching in supporting student ODPs to apply bioscience knowledge to their clinical practice.

The student responses supported our view that bioscience knowledge is essential for safe, effective care within the perioperative environment. It was interesting to note that the students were able to appreciate the relationship between bioscience knowledge and the wider concepts of patient care, for example by being able to provide informed information to the patient regarding the care. Students also demonstrated that they understood their professional responsibility to raise concerns regarding clinical care and that this was related to their understanding of bioscience to enable them to knowledgeably challenge others in order to prevent errors.

This research also explored the location of bioscience learning and it was interesting that students recognised university teaching as the main contribution to their bioscience knowledge; especially as a minimum of 60% of the programme hours are completed in clinical practice. Students did however recognise the value of clinical practice in supporting their bioscience learning and therefore we feel the factors which impact this are worthy of further exploration.

The research supports the link made elsewhere in the literature, and is evident in other health professions, between the application of biosciences in ODP and safe and effective practice. In our view this should naturally raise the issue of curriculum effectiveness within the undergraduate arena. We view the research as a catalyst for our own reflexivity and welcome wider debate amongst educators and practitioners alike to examine the position and effectiveness of biosciences in similar ODP programmes. We therefore welcome further debate, not to mention additional research, and are mindful that our findings here represent a snapshot taken from a wider study. Additional research could allow for greater comparison with other health professional groups, locating our findings around bioscience learning in ODP to other learners, contexts and clinical areas. We also feel that further investigation could be done to understand the impact of bioscience learning at various stages and levels as students progress through the course itself. Finally, a comparison of bioscience learning and the impact upon safe practice across a range of existing ODP qualifications would prove in our view, to be necessary and worthwhile, in terms of personal and professional accountability, and could have a significant bearing on continuing professional development and future curriculum development.

In recognising the absolute need for further inclusion of biosciences within revised national standards (SoPs), we accept that these advancements are ultimately intended to address issues of public protection and safety. Given that our findings reflect this, we feel that this may require not just amendments to the curriculum but perhaps an overhaul of the underlying philosophy that underpins national curriculum guidance. Our findings suggest that there is a dissonance between theory and practice in relation to the location and application of bioscience learning, which cannot be taught solely in the classroom nor in isolation of practice. We also conclude that the findings challenge the orthodoxy that has eroded the need for bioscience learning, only to be replaced with more psychosocial learning. Curriculum change required to scaffold more comprehensive bioscience learning will also influence both those who may choose to study ODP in the future, and those who educate ODPs.

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